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PRACTICAL METHODS OF DISINFECTING STABLES.

BY

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., November 7, 1911.

SIR: I have the honor to transmit herewith a paper on "Practical Methods of Disinfecting Stables," by Dr. George W. Pope, veterinary inspector in the Quarantine Division of this bureau, with the recommendation that it be published as a Farmers' Bulletin.

Respectfully,

A. D. MELVIN,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

[A list giving the titles of all Farmers' Bulletins available for distribution will be sent free upon application to a Member of Congress or the Secretary of Agriculture.]

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CONTENTS.

ILLUSTRATIONS.

PRACTICAL METHODS OF DISINFECTING STABLES.

In the work of the Bureau of Animal Industry in dealing with infectious diseases of live stock it has been found that the average stockman and farmer does not realize the importance of thoroughly disinfecting his premises following an outbreak of contagious disease. There is apparently a widespread lack of information regarding the germicidal power of various substances, commonly termed disinfectants. There is also a lack of knowledge concerning practical and economical methods of proceeding with the work of disinfection. Moreover, the reappearance of a contagious disease on premises from which it was believed to have been eradicated may frequently be traced to careless or imperfect work in connection with the cleaning and disinfection of the place.

This bulletin has been prepared with a view to emphasizing the importance of the thorough disinfection of contaminated buildings and to pointing out some of the most reliable disinfecting agents, together with methods of their application.

THE NECESSITY FOR DISINFECTION.

It is but natural to acknowledge the presence of only such objects as can be seen with the unaided eye. Science, however, by means of the high-power microscope, has clearly proved the existence of numerous minute animal and vegetable organisms—microorganisms—and it is a matter of common knowledge that many of these organisms frequently find their way into the animal body and produce disease. It is also well known that these microorganisms, or germs, vary in form and other characteristics and that for each disease of an infectious nature there is a specific germ.

If these germs could be confined to the animal body and die with it there would be no such thing as an infectious disease. Unfortunately, however, they are thrown off by the animal through the excretions and lie in the earth, in the litter of stables, upon the floor and walls, and in cracks and crevices. Here they may remain and maintain their virulence for an indefinite period, ready at any time to be gathered up by an animal in its feed or to be blown about in dust and drawn into the lungs.

For example, we have tuberculosis in cattle and glanders in the horse. In the former disease the causative agent is a rod-shaped

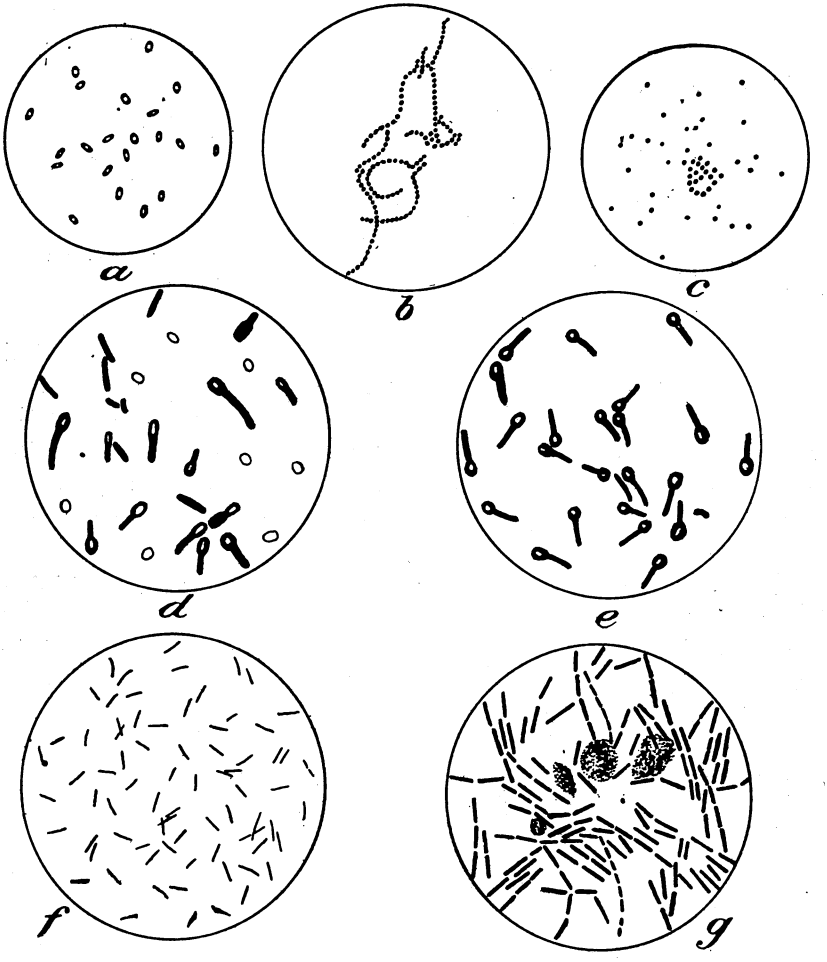

FIG. 1.—Various bacteria which produce disease in cattle.

a, Bacteria from pneumonia. These are also the cause of hemorrhagic septicemia.

b, Micrococci (streptococcus) which produce inflammation of the lining membranes of the abdomen, thorax, heart, brain, and joints. Frequently associated with the preceding bacteria in abscesses.

c, Micrococci (staphylococcus) which produce inflammation and suppuration, also pyemia.

d, Bacilli of blackleg. The oval bodies as well as the light spots in one end of the bacilli represent spores.

e, Bacilli which produce tetanus or lockjaw. The light spot in the enlarged end of each rod represents a spore.

f, Bacilli of tuberculosis.

g, Bacilli of anthrax.

(All but *g* are magnified 1,000 times; *g*, 500 times.)

germ (*Bacillus tuberculosis*), which is about one-thousandth of an inch in length. (See fig. 1, *f*.) Cattle affected with tuberculosis pass

myriads of these germs with the manure, and it is not difficult to understand how in the average stable they would have little difficulty in finding many lodging places. In glanders the causative agent is another rod-shaped germ (*Bacillus mallei*), about the same length as the tuberculosis germ, but somewhat thicker. A characteristic of this disease is the formation of ulcers in the nostrils and other portions of the body, from which there is more or less discharge laden with the glanders germ. And here, again, it is not difficult to understand how one diseased animal may contaminate extensive premises.

As has been stated, some of these minute forms are vegetable organisms. In fact, these vegetable parasites are the cause of some of the

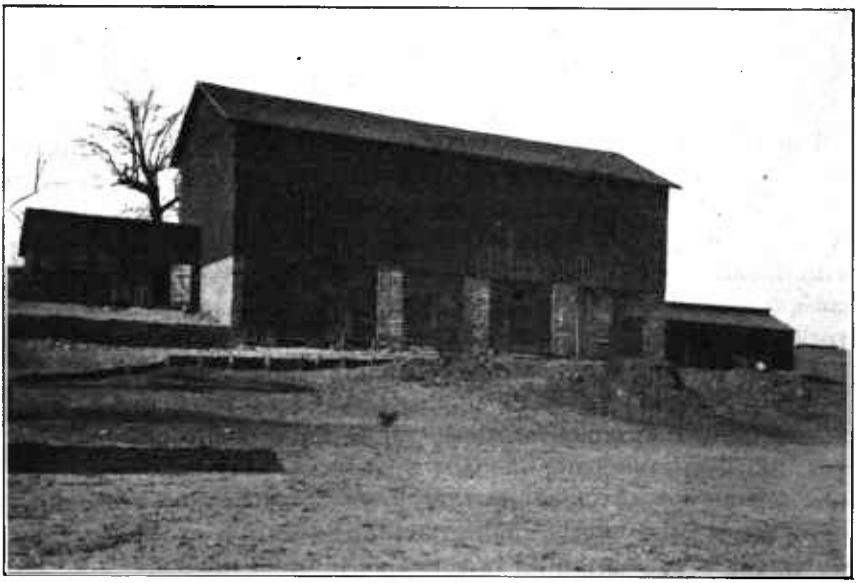

FIG. 2.—A stable with insufficient light and ventilation. Such a building is a favorable place for the existence of disease germs.

most destructive diseases, and some of them are very difficult to destroy, for the reason that they contain spores. (See fig. 1, *d* and *e*.) A spore may be likened to the seed of a plant, for it bears about the same relation to the bacillus that a grain of wheat does to the plant proper. As the plant may be destroyed and the seed remain latent for an indefinite time, so destruction of the bacillus may be easily accomplished while the spores remain unharmed and retain life for weeks or months.

An example of this class of organisms is seen in the agent which causes anthrax (*Bacillus anthracis*). Ordinary methods for the destruction of the bacillus will not destroy the spore as well, and thus anthrax becomes a most difficult disease to eradicate. Upon farms

where animals have died from anthrax and the carcasses have been buried instead of destroyed, repeated outbreaks of the disease may occur from time to time, possibly extending over a period of several years. This condition is due to the existence of the very resistant spores, which under favorable circumstances are carried to the surface of the earth and become infecting organisms—much as the seed of a noxious weed, after remaining in the soil during the winter, finds the conditions favorable in the spring and develops into a plant—except that these minute forms of life multiply with the most wonderful rapidity.

Thus it is that our increased knowledge regarding microorganisms or bacteria as the cause of many animal diseases has emphasized the importance of disinfection.

THE NATURE OF DISINFECTION.

The work of disinfection is based upon our recognition of the presence of disease germs, and disinfection means the act of destroying the cause of the infection. In other words, disinfection is a removal of the cause, and it will be clear to any practical man that in dealing with disease any effort which stops short of a complete removal of the cause is most unwise and unprofitable. To those unaccustomed to the work, disinfection may seem a most complicated process. Any approved method, however, is comparatively simple when carried out carefully, although like many another procedure it is one in which attention to details counts for much. It is important to bear in mind that the causative agents of many diseases are extremely small and may remain for an indefinite time in dust, cracks, and crevices of buildings, so that efforts aiming at the eradication of disease from contaminated premises must be thorough in order to be effective.

DISINFECTANTS.

In the work of disinfection nature has provided man with a most valuable ally—sunlight. It is well known that the direct rays of the sun are destructive to many forms of bacteria, in some cases destroying them and in others lessening their influence. Thus the importance of well-lighted stables is evident. The dark and sunless building will be a favorable breeding place for bacteria, and the structure which admits the greatest amount of sunlight will be the least favorable for their development. Again, heat will destroy the bacteria of disease. By this is not meant the ordinary heat of the sun, but heat as developed in boiling water or in flame. It is upon this principle that the surgeon before operating renders his instruments free from the possible presence of bacteria by boiling, and it

is heat which renders a jet of live steam destructive to bacteria. Sunlight, however, can not be considered more than an accessory in the destruction of bacteria, while the application of heat in the form of steam or flame is seldom possible. The result is that in the practical work of disinfection we are dependent upon certain drugs, which have power to destroy the organisms of disease.

Such drugs are known as disinfectants, and, fortunately, we have at hand a number that possess the power of destroying bacteria. It is not the purpose here to consider further the relative values of these drugs, neither will it be necessary to discuss the exact manner in

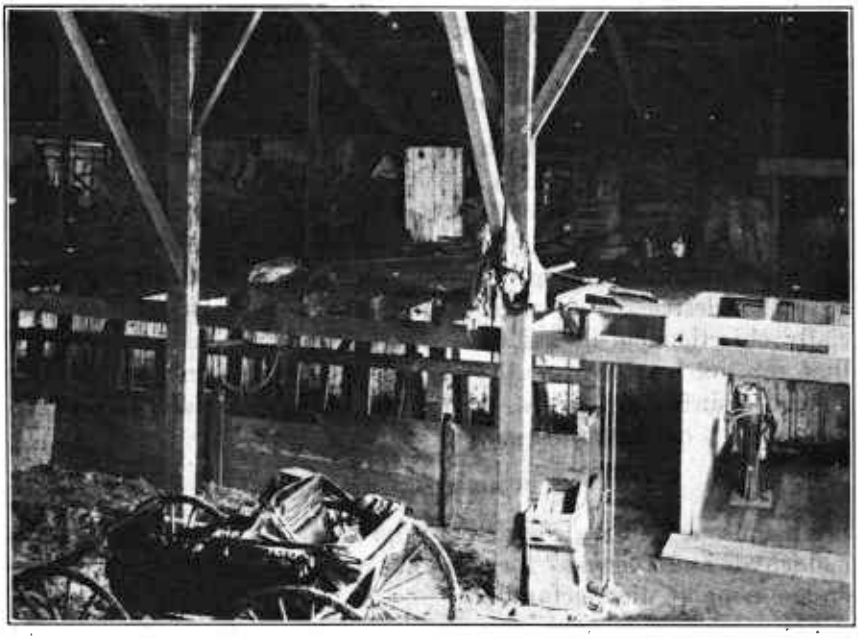

FIG. 3.—A stable that is difficult and expensive to keep clean and free from the contamination of animal diseases. Before beginning the disinfection of this stable a thorough cleaning would be essential.

which they act. It is sufficient to know that they possess the power of destroying bacterial life with the same certainty that poisonous drugs destroy animal life. They have only to be brought in contact with the bacteria in order to destroy them. As disinfecting drugs vary more or less in potency and in adaptability to general use, possessing certain advantages as well as disadvantages, it may be well to describe briefly a few of the commoner forms.[1]

[1] For fuller details regarding disinfecting agents the reader is referred to Farmers' Bulletin 345, U. S. Department of Agriculture, entitled "Some Common Disinfectants," by Dr. M. Dorset, chief of the Biochemic Division, Bureau of Animal Industry, from which some of the information herein given has been derived.

BICHLORID OF MERCURY.

Bichlorid of mercury, also known as corrosive sublimate and mercuric chlorid, is used in solution in water, commonly in a strength of 1 to 1,000, though solutions of double such strength may be employed. Although possessing great germicidal power, it has the disadvantages of being a violent poison, of corroding metals, and of uniting with albuminous substances, such as excreta, blood, etc., and thus forming inert compounds. Unlike the coal-tar products, it leaves no odor in the stable, which is an advantage in connection with the production of milk. On the other hand, care must be used in the handling of a solution of this drug, and feed boxes to which it has been applied should be washed with clear water before animals are again permitted access to them.

CHLORID OF LIME.

Chlorid of lime (sometimes termed chlorinated lime) is a well-known disinfectant, although its value is doubtless greatly overrated. This may be due in part to the fact that it is a powerful deodorant—such drugs on account of their pungent odor being popularly believed to have great disinfecting power. Being of uncertain strength and somewhat destructive to metals, and having a permeating odor especially objectionable in a stable where milk is produced, chlorid of lime can not be classed as the most desirable of disinfectants. For general disinfecting purposes it may be mixed with water in the proportion of 6 ounces to the gallon.

FORMALDEHYDE.

An aqueous solution containing approximately 40 per cent of formaldehyde and known as formalin has of recent years become a more or less popular disinfectant.

Formaldehyde is used in either liquid or gaseous form. In the former case formalin is mixed with water in the proportion of 6 ounces to the gallon, and the resulting solution is applied directly to surfaces or substances which are to be disinfected.

Formaldehyde gas is in most cases impracticable for stable disinfection. Where, however, a stable can be made almost air tight, and the animals removed, it will be found very serviceable, as it penetrates every crevice.

Several methods are in vogue for disinfecting with formaldehyde gas. Probably one of the most simple and practical methods of liberating such gas is by means of the chemical reaction which takes place when formalin is poured upon permanganate of potassium. For each 1,000 cubic feet of air space 16⅔ ounces of crystallized or powdered permanganate of potassium is placed in a wide-surfaced pan; 20 ounces of formalin is then poured upon it, and the room

immediately closed for a period of 12 hours or longer. This method is efficient only when it is possible to seal tightly the rooms or compartments to be disinfected and when their temperature is not below 50° F.

CARBOLIC ACID.

Carbolic acid in its pure form is, at ordinary temperatures, in the shape of long, white crystals. For convenience it is frequently dispensed in liquid form by the addition of 10 per cent of water. A 5 per cent solution of carbolic acid is sometimes used as a disinfectant, but carbolic acid has the disadvantage of being expensive and somewhat difficult to dissolve.

CRUDE CARBOLIC ACID.

This substance should not be confused with pure carbolic acid. It is a product of coal-tar distillation and consists for the most part of practically inert oils and cresylic acid. Its disinfecting power depends upon the amount of cresylic acid which it contains, as well as the relative percentage of hydrocarbon oils. Owing to its uncertain composition, crude carbolic acid can not be classed as one of the most desirable disinfectants.

CRESOL.

Cresol, commonly termed "straw-colored carbolic acid," "liquid carbolic acid," etc., in a 2 per cent solution is an efficient disinfectant. It has the disadvantage, however, of being somewhat difficult to dissolve, so in preparing a disinfecting solution warm water should be used and care exercised that the drug is entirely dissolved. As the disinfecting power of cresol is dependent upon the amount of cresylic acid contained therein, it is essential when using the drug to know the degree of purity. Grades can be purchased under a guaranty to contain from 90 to 98 per cent of cresylic acid. Any containing less than 90 per cent should be rejected.

COMPOUND SOLUTION OF CRESOL.

Compound solution of cresol (liquor cresolis compositus), now recognized by the United States Pharmacopœia as an official preparation, is composed of equal parts of cresol (U. S. P.) and linseed oil-potash soap. It is an efficient disinfectant in a 4 per cent solution and has the advantage of mixing readily with water.

DETAILS OF DISINFECTION.

In the practical work of disinfection there are three essentials:

1. A preparation of the building that will facilitate reaching organisms of disease.

2. A disinfectant which upon contact can be depended upon to destroy such organisms.

3. A method of applying the disinfectant that will assure the most thorough contact with the bacteria.

PREPARATION OF BUILDING.

Before beginning the use of a disinfectant it is essential that certain preliminary work be done in and about the stable that is to be

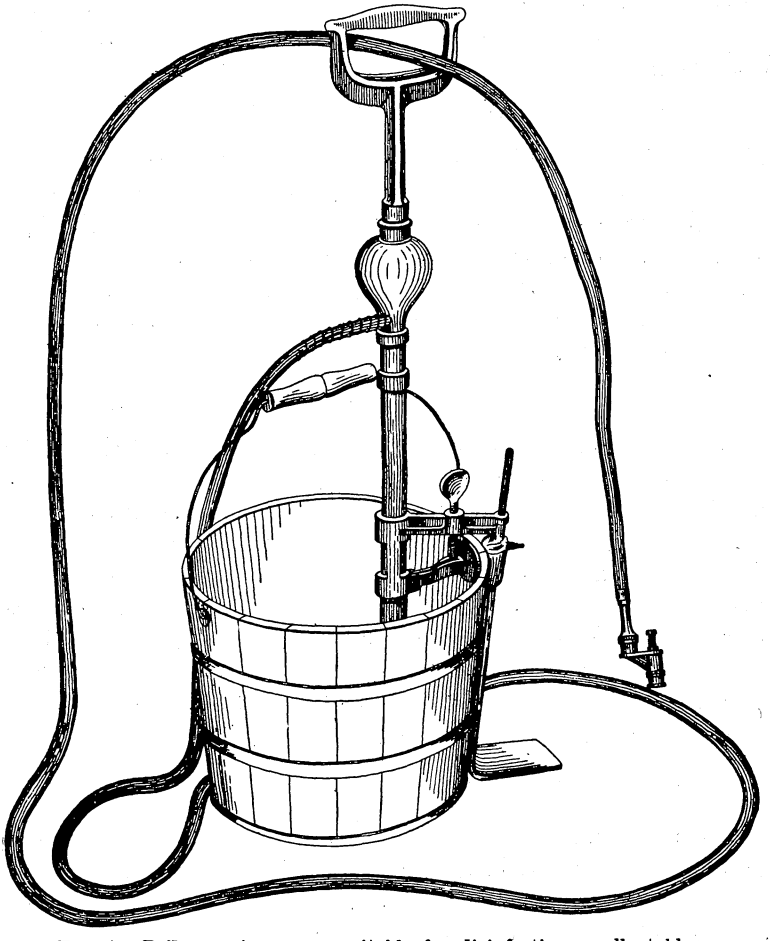

FIG. 4.—Pall spraying pump suitable for disinfecting small stables.

treated. The various surfaces, such as ceiling, walls, partitions, floors, etc., should be swept until free from cobwebs and dust. Any accumulation of filth should be removed by scraping. In some cases the woodwork may have become softened and so porous as to be a good medium for the absorption of disease germs. Such woodwork should be removed, burned, and replaced with new material.

All refuse, manure, etc., from stable and barnyard should be removed to a place inaccessible to live stock and, if possible, be burned or thoroughly mixed with a solution of chlorid of lime in the proportion of 6 ounces to 1 gallon of water. If the floor is of earth, it will doubtless have become stained with urine and contaminated to a depth of several inches. In such cases 4 inches or more of the surface soil should be removed and treated as above suggested for refuse and excreta. All earth removed should be replaced with soil from an uncontaminated source, or better, a new floor of concrete may be laid, this being the most durable and sanitary material for the purpose.

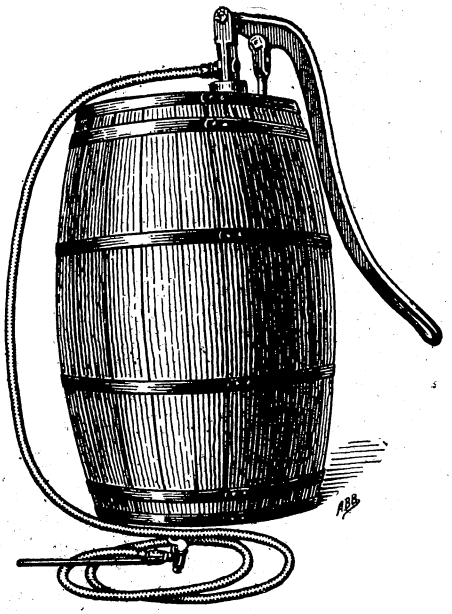

FIG. 5.—A good type of barrel sprayer.

SELECTION AND PREPARATION OF THE DISINFECTANT.

Having made ready the field of operation, the next consideration should be the selection and preparation of the disinfectant. The fact must not be overlooked that many agents used for the destruction of bacteria are likewise poisonous to animals and man. In fact, some drugs, although powerful as germicides, are so poisonous as to preclude their general use in the work of disinfection. Among such, as previously stated, is bichlorid of mercury, which possesses the power of destroying not only bacteria, but spores as well. It is therefore essential in deciding upon an agent to select one having a known germicidal strength, properties of solubility, and at the same time possessing a reasonable degree of safety to animals and man.

All things considered, it is probable that some of the coal-tar products best fulfill these requirements. In this class is the compound solution of cresol, already mentioned, a preparation recognized as official by the United States Pharmacopœia and known as liquor cresolis compositus (U. S. P.). This preparation mixes readily with water and will prove a very efficient disinfectant. It should be used in the proportion of 4 or 5 ounces to each gallon of water.

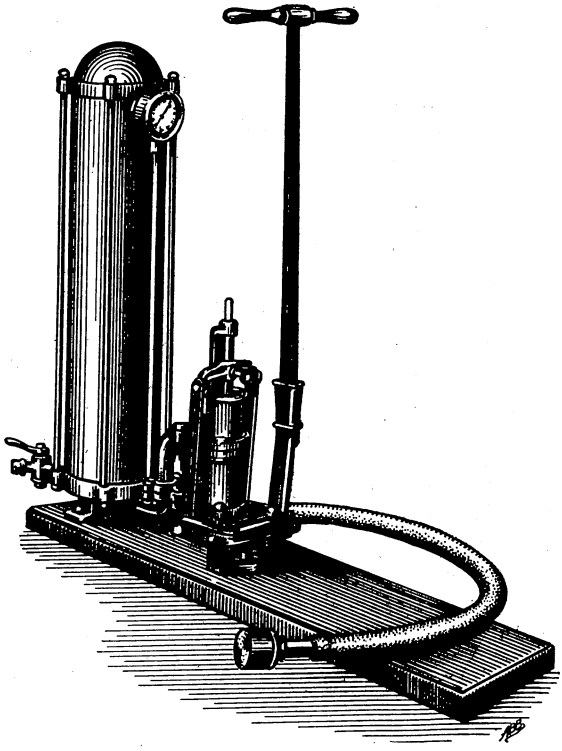

FIG. 6.—A double-acting sprayer, with air chamber.

Another favorable agent is cresol (commercially known as liquid carbolic acid). It is not as soluble as liquor cresolis compositus and should be thoroughly stirred during the process of mixing, which will be facilitated by using hot water. It is advisable to secure a grade of the drug with a guaranty of 95 per cent pure, and such should be used in the proportion of 2 or 3 ounces to a gallon of water.

As an accessory preparation and for use after the application of the disinfectant it may be advisable to make ready a lime wash to each gallon of which there has been added 4 ounces of chlorid of lime, or if it appears desirable to use the disinfectant and lime wash at one application, the following method may be followed

in preparing 5 gallons: Slake 7½ pounds of lime, using hot water if necessary to start action. Mix to a creamy consistency with water. Stir in 15 fluid ounces of cresol (commercially known as liquid carbolic acid) at least 95 per cent pure, and make up to 5 gallons by adding water. In case compound solution of cresol (liquor cresolis compositus) is used, add 30 fluid ounces instead of 15 as in the case of cresol (liquid carbolic acid). Stir thoroughly. If to be applied through a spray nozzle, strain through a wire sieve. Stir frequently when applying and keep covered when not in use.

In case a large surface is to be disinfected it will be advisable to prepare a liberal amount of the disinfecting solution before beginning the application. Such solutions, however, should not be permitted to remain in receptacles which are accessible to animals.

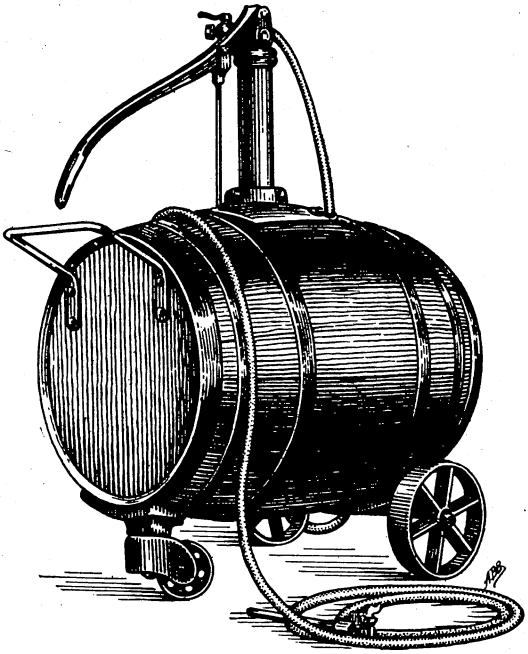

FIG. 7.—A whitewashing outfit.

METHOD OF APPLICATION.

The efficacy and economy of the work will depend in a great measure upon the method of applying the disinfectant. Economy requires that the disinfecting solution be applied rapidly; efficiency requires that it be not only spread in such manner as to cover the entire surface requiring disinfection, but that sufficient quantity and force be used to drive the solution into all cracks and crevices.

Where a very limited surface is to be treated, as, for example, one stall, it may be possible to apply the disinfectant in a satisfactory manner by means of a whitewash brush. In all cases, however, the best method of applying the disinfectant and the lime wash is by means of a strong spray pump. Such should be equipped with not less than 15 feet of hose, to which may be attached a 5-foot section of iron pipe of the same caliber. With a spraying nozzle at the

FIG. 8.—Applying the disinfectant.

end of the pipe the operator will be enabled to proceed with the greatest possible dispatch and the least possible inconvenience.

The entire interior of the stable should be saturated with the disinfectant. Special attention should be given to the feeding troughs and drains. After this has dried the surface may be sprayed with lime wash, provided this has not been combined with the disinfectant as described on page 15; and when this process has been completed it will be advisable to open all doors and windows of the building for the admission of air and light.